Inline terminal
with two SPDT (Form C) relays:
ILT 24/48 DOR2/W

Device description

SysMik® GmbH Dresden

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1 Description

The terminal is designed for use within an Inline station. It has two SPDT (form C) relay contacts, which are independent of each other.

ATTENTION:
Danger from undefined system state!
By default, the relay contact positions of the terminal are not defined. Power cycle (on/off) the terminal completely before connecting the segment voltage in order to avoid undesirable system states.

Note: This device description is only valid in association with the IL SYS INST UM user manual or the Inline system manual of the specifically used bus system.
Make sure you always use the latest documentation – it can be downloaded at www.sysmik.de.

Note:
The terminal must only be used in the SELV area (up to 50 V AC or 120 V DC, maximum).

Features

- Two SPDT (Form C) relays
- Floating connections for two actuators
- Nominal current of the output: 2 A
- Total current of the terminal: 4 A
- Diagnostic and status indicators
- Segment voltage U_S

2 Order information

Description	Type	Part number	Pcs./Pkt.
Terminal with two digital relay outputs; including connector and labeling field	ILT 24/48 DOR2/W	1225-100505-01-2	1

Optional Add-Ons (Purchase via Phoenix Contact):

Description	Type	Part number	Pcs./Pkt.
User Manual: ‚Configuring and Installing the INTERBUS-Inline Product Range‘	IL SYS PRO UM E	2743048	1

3 Technical data

General data	
Housing dimensions (width x height x depth)	12,2 mm x 120 mm x 71,5 mm (0.480 in x 4.724 in. x 2.815 in.)
Weight	48 g (without connector), 63 g (incl. connector)
Operating mode	Process data mode with 2 bits
Connection method for actuators	To two floating relay changeover contacts
Permissible temperature (operation)	-25 °C to +55 °C (-13°F to +131°F)
Permissible temperature (storage/transport)	-25 °C to +85 °C (-13°F to +185°F)
Permissible humidity (operation)	75 % on average, 85 % occasionally
⚠ In the range from -25°C to +55°C (-13°F to +131°F) appropriate measures against increased humidity (> 85 %) must be taken.	
Zulässige Luftfeuchtigkeit (Lagerung/Transport)	75 % on average, 85 % occasionally
⚠ For a short period, slight condensation may appear on the outside of the housing if, for example, the terminal is brought into a closed room from a vehicle.	
Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2000 m [6562 ft.] above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m [9843 ft.] above sea level)
Degree oft protection	IP20 according to IEC 60529

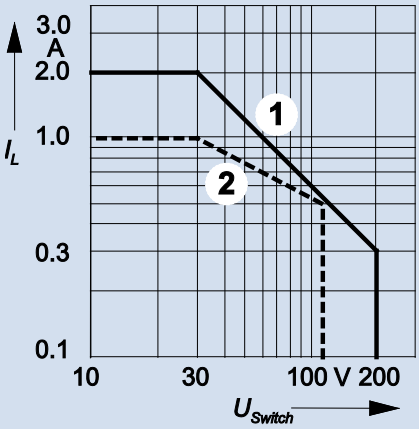
Power consumption	
Communications power	7,5 V DC
Current consumption from the local bus	30 mA
Power consumption from the local bus	0,23 W

Supply of the Module Electronics and I/O Through Bus Terminal/Power Terminal	
Connection method	Trough potential routing

Relay output	
Number	2
Contact material	$AgSnO_2$, hard gold-plated
Contact resistance	75 mΩ
Limiting continuous current (at maximum ambient temperature)	2 A
Maximum switching voltage	50 V AC, 120 V DC
Maximum switching power (AC/DC)	60 W, 62,5 VA (ohmic load)
Minimum load	10 mV DC; 10 µA
Switching current at 30 V DC	2 A
Switching current at 60 V DC	1,0 A
Maximale Einschaltstromspitze bei Lampenlasten und kapazitiv wirkenden Lasten	6 A für T = 200 µs
See also the Table entitled "Maximum Switching Current for Ohmic Load Depending on the Switching Voltage"	
Nominal power consuption oft the coil (at 20 °C [68 °F])	200 mW, bistable relay, no power in the switched state
Resistance of the coil (at 20 °C [68 °F])	178 Ω ± 10 %
Maximum switching frequency (without load)	1 Hz
Maximum switching frequency (with nominal load)	1 Hz
Response delay	20 ms, typical
Bouncing time	4 ms with on and off
Release time	20 ms, typical
Mechanical life	10^8 cycles
Electrical life (30 V DC, 1 A)	2×10^5 cycles
Common potentials	All contacts floating

Maximum Switching Current for Ohmic Load Depending on the Switching Voltage	
Switching voltage (V DC)	**Switching current (A)**
10	2,0
20	2,0
30	2,0
60	1,0

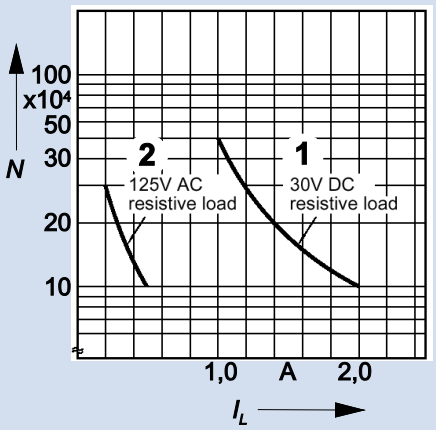
Load current (I_L in A) as a function of switching voltage (U_{Switch} in V)



1 … DC, ohmic load

2 … AC, ohmic load

Number oft operations (N x 10^4) as a funktion of load current (I_L in A)



1 … 30 V DC, ohmic load

2 … 120 V AC, ohmic load

Power dissipation

Formula to calculate the power dissipation of the terminal

$P_{EL} = P_{BUS} + P_L$

$$P_{EL} = 0.23\ W + m\ 0.14\ W + \sum_{n=1}^{2} [I_{Ln}^2 \times 0.075]$$

Where:

P_{EL}	Total power dissipation in the terminal
P_{BUS}	Power dissipation through bus operation
P_L	Power dissipation through the load current via the contacts
n	Index of the number of loaded outputs n = 1 to 2
m	Number of relays with controlled coil
I_{Ln}	Load current of the output n

Power Dissipation of the Housing Depending on the Ambient Temperature	
P_{HOU} = 1,2 W P_{HOU} = 1,2 W - ((T_U -25 °C) x 0,02 W/°C) where: P_{HOU} permissible power dissipation oft the housing T_A ambient temperature	-25 °C < T_U ≤ +25 °C +25 °C < T_U ≤ +55 °C

Derating when using the N/O contact			
Ambient temperature T_A	**Power dissipation of the housing**	**Maximum load current (100 % simultaneity)**	**Maximum load current (50 % simultaneity)**
40 °C	0,9 W	2,0 A	2,0 A
55 °C	0,6 W	1,0 A	2,0 A

Safety equipment
none

Error messages to the higher level control or computer system
none

Air and creepage distances (according to EN 50178, VDE 0109, VDE 0110)			
Isolating distance	**Air distance**	**Creeping dist.**	**Test voltage**
Relay contact/bus logic	≥ 1,5 mm	≥ 1,5 mm	4 kV, 50 Hz, 1 min.
Contact/contact	≥ 1,5 mm	≥ 1,5 mm	1 kV, 50 Hz, 1 min.
Contact/PE	≥ 3,1 mm	≥ 3,1 mm	1 kV, 50 Hz, 1 min.
Relay/relay	keine		

4 Special fatures of the terminal

Switching a Voltage Equal to the Segment Voltage

The potential U_S is available at the terminal points 1.1 and 1.2.

Inserting a jumper between 1.1 and 1.3 or 2.1 and 2.3 enables connecting the segment voltage potential to the main contact of the relevant relay in order to switch the load in a **non-floating** manner.

If no jumpers are inserted, switching the load can also be **floating**.

Switching a Voltage Unequal to the Segment Voltage – Different DC voltages

Distance terminals are not required.

Inserting a jumper is not useful and not permitted. It is only permitted to switch the load in a **floating** manner.

If the switch contact potentials and the segment circuit potential are two different DC circuits, Phoenix Contact recommends using a ground connection between the two power supply units.

Switching an AC voltage within a DC segment circuit

Distance terminal must be used.

The distance terminals interrupt the potential jumpers. As a result, no segment voltage is present at the terminal points 1.1 and 2.1. It is only possible to switch the connected load in a **floating** manner.

When switching voltages outside the SELV area, use the Inline terminals ILT 24/230 DOR 1/W or ILT 24/230 DOR 4/W ein.

5 Local diagnostic and status indicators and terminal point assignment

Local diagnostic and status indicators

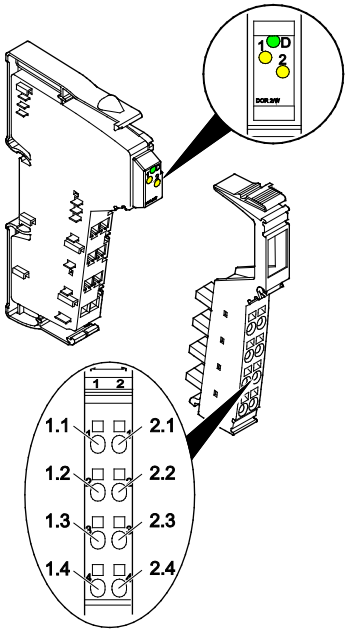


Fig. 1: Terminal with appropriate connector

Functional identification

- Pink

Housing / connector color

- Green housing
- Green connector, without color print

Local diagnostic and status indicators

Des.	Color	Meaning
D	green	Diagnostics
1	yellow	Output status indicator (relay energized)
2	yellow	Output status indicator (relay energized)

Terminal point assignment per each connector

Terminal point	Assignment
1.1, 2.1	Segment voltage U_S
1.2	N/C contact oft relay 1
1.3	Main contact oft relay 1
1.4	N/O contact oft relay 1
2.2	N/C contact oft relay 2
3.3	Main contact oft relay 2
2.4	N/O contact oft relay 2

6 Internal circuit diagram

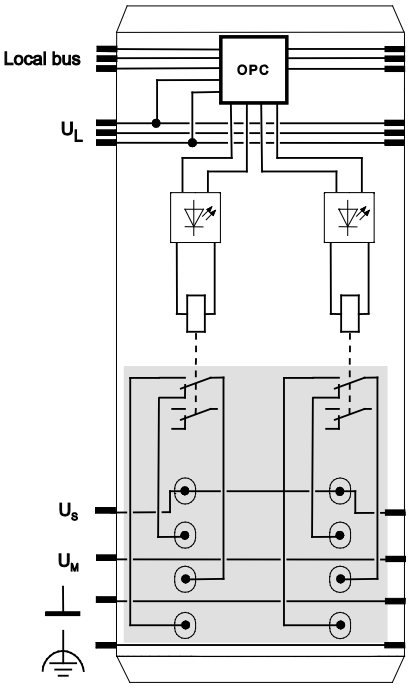


Fig. 2: Internal wiring of the terminal points

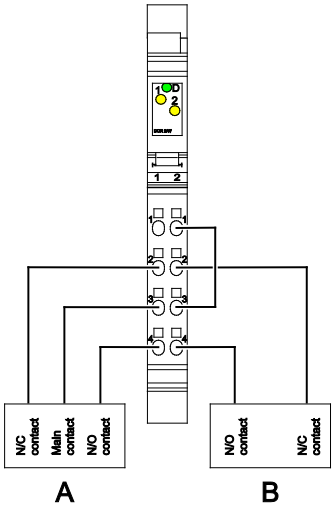
Key:

OPC	Protocol chip (-bus logic including voltage conditioning)		Relay, SPDT (Form C)
	LED		Electrically isolated area: I/O area including relay contact isolated from the logic area including the relay coil

Note: Other symbols used are explained in the IL SYS INST UM E user manual or in the manual oft the used bus system.

7 Connection examples

Connecting actuators



A … Floating actuator connection

B … Non-floating actuator connection

Fig. 3: Typical connection oft actuators

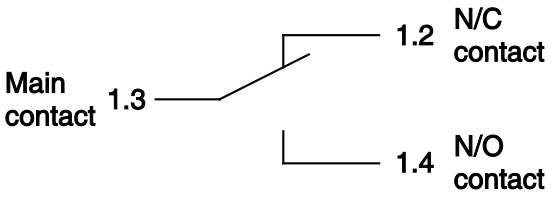


Fig. 4: Output relay form C contacts

Switching voltages
that are not available in the segment

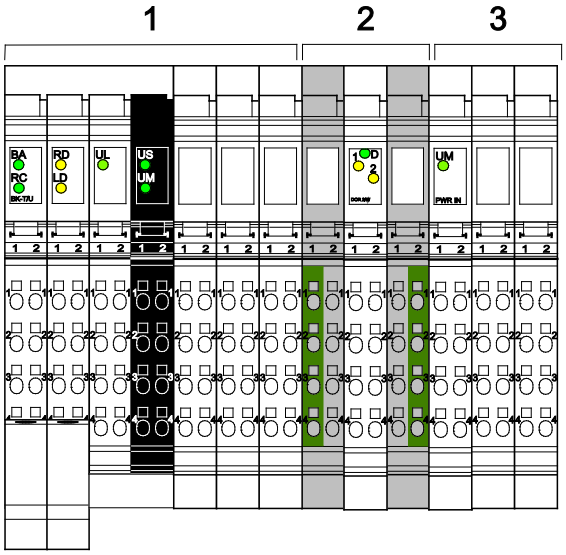


Fig. 5: Switching 48 V within a 24-V-area

1 24-V-area consisting of bus terminal and I/O terminals

2 ILT 24/48 DOR 2/W terminal separated from the 24-V-area by distance terminals

3 24-V-area consisting of a power terminal and I/O terminals

See also ‚Special features of the terminal'!

As the distance terminals interrupt all the potential jumpers, U_S is not available at the terminal points 1.1 and 2.1 in this case. In this case the connected load can only be switched in a floating manner.

Switching voltages
that are available in the segment

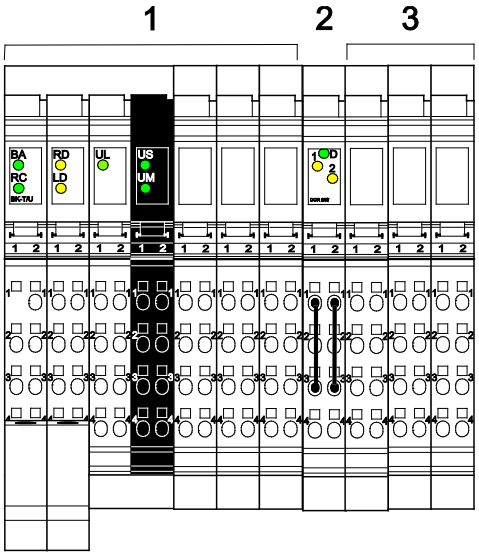


Fig. 6: Switching 24 V within a 24-V-area

1 24-V-area consisting of bus terminal and I/O terminals

2 ILT 24/48 DOR 2/W terminal

3 24-V-area consisting of I/O terminals or a power terminal and I/O terminals

Distance terminals are not required when switching e.g., a 24-V-channel within a 24-V-area!

When using several ILT 24/48 DOR 2/W terminals SysMik recommends creating a separate main circuit with separate supply!

8 Interference Suppression Measures on Inductive Loads/Switching Relays

Each electrical load is a mixture of ohmic, capacitive, and inductive elements. Depending on the proportion of the element, switching these loads results in a larger or smaller load on the switch contact.

In practice, loads are generally used with a large inductive element, such as contacts, solenoid valves, motors, etc. Due to the energy stored in the coils, voltage peaks of up to several thousand volts may occur when the system is switched off. These high voltages cause an arc, which may destroy the controlling contact through material evaporation and material transfer.

This pulse, which is similar to a square wave pulse, emits electromagnetic pulses over a wide frequency range with a large amount of power and with spectral elements reaching several MHz.

To prevent such arcs from occurring it is necessary to fit the contacts/loads with protective circuits. The following protective circuits can be used:

- Contact protective circuit
- Load protective circuit
- Combination of both protective circuits.

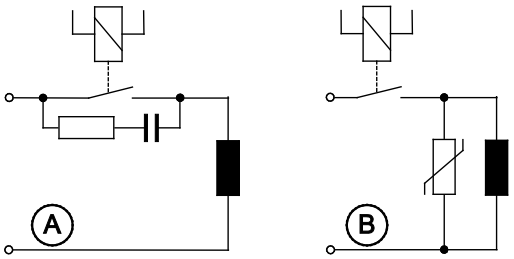


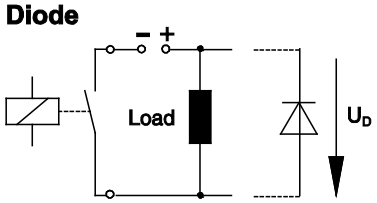
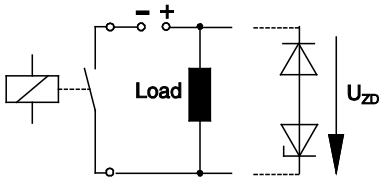
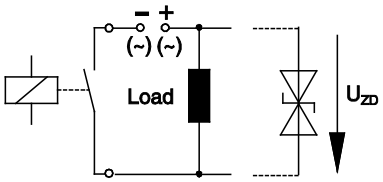
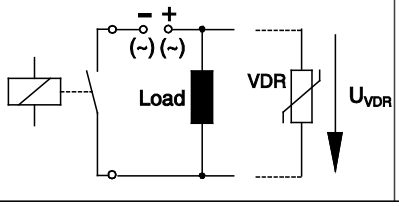
Bild 7: Contact protective circuit (A), Load protective circuit (B)

If sized correctly, these circuit versions do not differ greatly in their effectiveness. In principle, a protective measure should be directly implemented at the source of the interference. The following points speak in favor of a load protective circuit:

- When the contact is open, the load is electrically isolated from the operating voltage.
- It is not possible for the load to be activated or to "stick" due to undesired operating currents, e.g., from RC elements.
- Shutdown voltage peaks cannot be coupled in control lines that run in parallel.

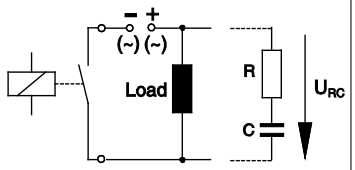
Today the majority of contactor manufacturers offer diode, RC or varistor elements that can be snapped on. For solenoid valves, connectors with an integrated protective circuit can be used.

Circuit versions

Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/disadvantage
Diode 	Large	Yes (U_D)	No	Advantages: - Easy implementation - Cost-effective - Reliable - Uncritical sizing - Low induction voltage Disadvantages: - Attenuation only via load resistance - High dropout delay
Diode/Zener diode series circuit 	Medium to small	Yes (U_{ZD})	No	Advantages: - Uncritical sizing Disadvantages: - Attenuation only above U_{ZD}
Suppressor diode 	Medium to small	Yes (U_{ZD})	Yes	Advantages: - Cost-effective - Uncritical sizing - Limitation of positive peaks - Suitable for AC voltages Disadvantages: - Attenuation only above U_{ZD}
Varistor 	Medium to small	Yes (U_{VDR})	Yes	Advantages: - High energy absorption - Uncritical sizing - Suitable for AC voltages Disadvantages: - Attenuation only above U_{VDR}

RC circuit versions:

RC connected in series

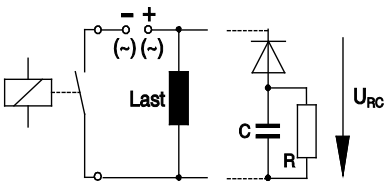
Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/Disadvantages
R/C combination 	Medium to small	No	Yes	Advantages: - HF attenuation due to energy absorption - Suitable for AC voltages - Level-independent attenuation - Reactive-current compensation Disadvantages: - Precise sizing required - High inrush current flow

Sizing:

Capacitor: $C \approx L_{Load} / 4 \times R_{Load}^2$

Resistor: $R \approx 0{,}2 \times R_{Load}$

RC Parallelcircuit with series diode

Load circuit	Additional dropout delay	Defined induction voltage limitation	Bipolar attenuation	Advantages/Disadvantages
R/C combination with diode 	Medium to small	No	Yes	Advantages: - HF attenuation due to energy absorption - Level-independent attenuation - Current reversal not possible Disadvantages: - Precise sizing required - Only suitable for DC voltages

Sizing:

Capacitor: $C \approx L_{Load} / 4 \times R_{Load}^2$

Resistor: $R \approx 0{,}2 \times R_{Load}$

Switching AC/DC Loads

Switching Large AC Loads

When switching large AC loads, the relay can be operated up to the corresponding maximum values for switching voltage, current, and power. The arc that occurs during shutdown depends on the current, voltage, and phase angle. This shutdown arc switches off automatically the next time the load current passes through zero.

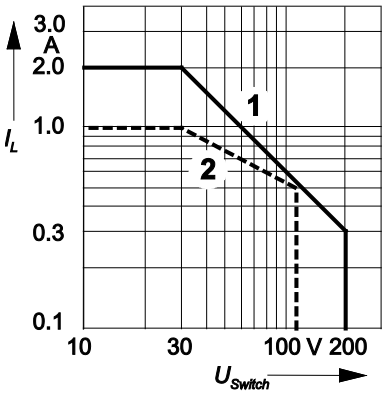
In applications with an inductive load, an effective protective circuit must be provided, otherwise the life of the system will be reduced considerably.

To prolong the life of the ILT 24/48 DOR 2/W terminal as much as possible when using lamp loads or -capacitive loads, the current peak must not exceed 2 A when the load is switched on.

Switching Large DC Loads

In DC operation, a relay can only switch a relatively low current compared with the maximum permissible alternating current. This maximum direct current value is also highly dependent on the voltage and is determined in part by design conditions, such as the contact distance and contact opening speed.

The corresponding current and voltage values are shown using the example in Figure 8



I Switching current in A

U Switching voltage in V

Definition of the load limiting curve:
For 1000 cycles, no constant arc should occur with a burning life of >10 ms.

Fig. 8: DC load limiting curve
(REL-SNR-1XU/G 5 GOLD LIEG relay)

An unattenuated inductive load further reduces the values for switching currents given here. The energy stored in the inductor can cause an arc to occur, which forwards the current via the open contacts. Using an effective contact protective circuit, the same currents can be switched as for an ohmic load and the life of the relay contacts is the same.

If it is permitted to switch higher DC loads, several relay contacts can be switched in parallel.

Additional technical data is available on request.